

**WHAT IS CLAIMED IS:**

1. An azeotrope-like 1,1,1,3,3-pentafluorobutane-containing composition,  
5 wherein said composition is selected from the group consisting of:
- (i) compositions consisting essentially of from about 1 to about 99 weight  
percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane and from about 1 to about 99  
weight percent 1,1,1,3,3-pentafluorobutane, wherein said composition has  
a vapor pressure of from about 58.6 kPa to about 100.9 kPa at a  
10 temperature of about 40°C;
- (ii) compositions consisting essentially of from about 1 to about 95 weight  
percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 1 to about 98  
weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 15  
weight percent of methanol, wherein said composition has a vapor pressure  
15 of from about 72.9 kPa to about 112.2 kPa at a temperature of about 40°C;
- (iii) compositions consisting essentially of from about 1 to about 95 weight  
percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 1 to about 98  
weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 15  
weight percent ethanol, wherein said composition has a vapor pressure of  
20 from about 72.2 kPa to about 105.5 kPa at a temperature of about 40°C;
- (iv) compositions consisting essentially of from about 1 to about 95 weight  
percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 1 to about 98  
weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 15  
weight percent isopropanol, wherein said composition has a vapor pressure  
25 of from about 61.8 kPa to about 103.2 kPa at a temperature of about 40°C;
- (v) compositions consisting essentially of from about 1 to about 70 weight  
percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 28 to about 98  
weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10  
weight percent acetone, wherein said composition has a vapor pressure of  
30 from about 73.8 kPa to about 100.3 kPa at a temperature of about 40°C;
- (vi) compositions consisting essentially of from about 1 to about 80 weight  
percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 1 to about 98  
weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 66

weight percent trans-1,2-dichloroethylene, wherein said composition has a vapor pressure of from about 102.8 kPa to about 118.8 kPa at a temperature of about 40°C;

5 (vii) compositions consisting essentially of from about 1 to about 60 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 40 weight percent trans-1,2-dichloroethylene and from about 1 to about 10 weight percent of methanol, wherein said composition has a vapor pressure of from about 116.0 kPa to about 128.2 kPa at a temperature of about 40°C;

10 (viii) compositions consisting essentially of from about 1 to about 60 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 40 weight percent trans-1,2-dichloroethylene and from about 1 to about 10 weight percent ethanol, wherein said composition has a vapor pressure of from about 107.1 kPa to about 118.5 kPa at a temperature of about 40°C;

15 (ix) compositions consisting essentially of from about 1 to about 60 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 40 weight percent trans-1,2-dichloroethylene and from about 1 to about 10 weight percent isopropanol, wherein said composition has a vapor pressure of from about 104.6 kPa to about 114.9 kPa at a temperature of about 40°C;

20 (x) compositions consisting essentially of from about 1 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 30 to about 98 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 49 weight percent n-propyl bromide, wherein said composition has a vapor pressure of from about 70.9 kPa to about 106.5 kPa at a temperature of about 40°C;

25 (xi) compositions consisting essentially of from about 1 to about 70 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35

weight percent n-propyl bromide, and from about 1 to about 10 weight percent of methanol, wherein said composition has a vapor pressure of from about 89.9 kPa to about 117.0 kPa at a temperature of about 40°C;

5 (xii) compositions consisting essentially of from about 1 to about 70 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35 weight percent n-propyl bromide, and from about 1 to about 10 weight percent ethanol, wherein said composition has a vapor pressure of from about 85.8 kPa to about 108.3 kPa at a temperature of about 40°C;

10 (xiii) compositions consisting essentially of from about 1 to about 70 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35 weight percent n-propyl bromide, and from about 1 to about 10 weight percent isopropanol, wherein said composition has a vapor pressure

15 of from about 78.7 kPa to about 105.1 kPa at a temperature of about 40°C;

(xiv) compositions consisting essentially of from about 1 to about 67 and from about 92 to about 99 weight percent nonafluoromethoxybutane and from about 33 to about 99 and from about 1 to about 8 weight percent 1,1,1,3,3-pentafluorobutane, wherein said composition has a vapor

20 pressure of from about 50.1 kPa to about 100.9 kPa at a temperature of about 40°C;

(xv) compositions consisting essentially of from about 1 to about 90 weight percent nonafluoromethoxybutane, from about 1 to about 98 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 15 weight

25 percent of methanol, wherein said composition has a vapor pressure of from about 77.9 kPa to about 113.2 kPa at a temperature of about 40°C;

(xvi) compositions consisting essentially of from about 1 to about 60 weight percent nonafluoromethoxybutane, from about 39 to about 98 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10

30 weight percent ethanol, wherein said composition has a vapor pressure of from about 82.7 kPa to about 105.3 kPa at a temperature of about 40°C;

(xvii) compositions consisting essentially of from about 1 to about 60 weight percent nonafluoromethoxybutane, from about 39 to about 98

weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10 weight percent isopropanol, wherein said composition has a vapor pressure of from about 82.1 kPa to about 103.1 kPa at a temperature of about 40°C;

(xviii) compositions consisting essentially of from about 1 to about 98 weight percent nonafluoromethoxybutane, from about 1 to about 98 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 98 weight percent acetone, wherein said composition has a vapor pressure of from about 52.1 kPa to about 100.3 kPa at a temperature of about 40°C;

(xix) compositions consisting essentially of from about 1 to about 75 weight percent nonafluoromethoxybutane, from about 1 to about 98 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 64 weight percent trans-1,2-dichloroethylene, wherein said composition has a vapor pressure of from about 93.4 kPa to about 118.7 kPa at a temperature of about 40°C;

(xx) compositions consisting essentially of from about 1 to about 60 weight percent nonafluoromethoxybutane, from about 20 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35 weight percent trans-1,2-dichloroethylene and from about 1 to about 10 weight percent of methanol, wherein said composition has a vapor pressure of from about 113.1 kPa to about 127.8 kPa at a temperature of about 40°C;

(xxi) compositions consisting essentially of from about 1 to about 50 weight percent nonafluoromethoxybutane, from about 20 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35 weight percent trans-1,2-dichloroethylene and from about 1 to about 10 weight percent ethanol, wherein said composition has a vapor pressure of from about 104.9 kPa to about 113.8 kPa at a temperature of about 40°C;

(xxii) compositions consisting essentially of from about 1 to about 50 weight percent nonafluoromethoxybutane, from about 20 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35 weight percent trans-1,2-dichloroethylene and from about 1 to about 9 weight percent isopropanol, wherein said composition has a vapor pressure

of from about 103.8 kPa to about 111.1 kPa at a temperature of about 40°C;

(xxiii) compositions consisting essentially of from about 1 to about 50 weight percent nonafluoromethoxybutane, from about 30 to about 98 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 49 weight percent n-propyl bromide, wherein said composition has a vapor pressure of from about 90.7 kPa to about 106.6 kPa at a temperature of about 40°C; and

(xxiv) compositions consisting essentially of from about 1 to about 70 weight percent nonafluoromethoxybutane, from about 10 to about 97 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 35 weight percent n-propyl bromide and from about 1 to about 10 weight percent of methanol, wherein said composition has a vapor pressure of from about 93.4 kPa to about 118.0 kPa at a temperature of about 40°C, and

wherein after 50 weight percent of said composition has evaporated the vapor pressure of the remaining composition has changed by about 10 percent or less.

2. The azeotrope-like 1,1,1,3,3-pentafluorobutane-containing composition of Claim 1, said composition is selected from the group consisting of:

(i) compositions consisting essentially of from about 10 to about 90 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane and from about 10 to about 90 weight percent 1,1,1,3,3-pentafluorobutane, wherein said composition has a vapor pressure of from about 65.9 kPa to about 98.9 kPa at a temperature of about 40°C;

(ii) compositions consisting essentially of from about 10 to about 40 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 50 to about 89 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10 weight percent of methanol, wherein said composition has a vapor pressure of from about 100.1 kPa to about 110.4 kPa at a temperature of about 40°C;

(iii) compositions consisting essentially of from about 10 to about 40 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 50 to

about 89 weight percent 1,1,1,3,3-pentafluorobutane, from about 1 to about 10 weight percent ethanol, wherein said composition has a vapor pressure of from about 96.9 kPa to about 103.8 kPa at a temperature of about 40°C;

5 (iv) compositions consisting essentially of from about 10 to about 40 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 50 to about 89 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10 weight percent isopropanol, wherein said composition has a vapor pressure of from about 92.5 kPa to about 101.1 kPa at a temperature  
10 of about 40°C;

(v) compositions consisting essentially of from about 10 to about 40 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 50 to about 89 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10 weight percent acetone, wherein said composition has a vapor  
15 pressure of from about 85.6 kPa to about 95.1 kPa at a temperature of about 40°C;

(vi) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane and from about 10 to  
20 about 45 weight percent trans-1,2-dichloroethylene, wherein said composition has a vapor pressure of from about 114.2 kPa to about 118.0 kPa at a temperature of about 40°C;

(vii) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to  
25 about 50 weight percent 1,1,1,3,3-pentafluorobutane, from about 15 to about 45 weight percent trans-1,2-dichloroethylene and from about 1 to about 6 weight percent of methanol, wherein said composition has a vapor pressure of from about 116.0 kPa to about 128.2 kPa at a temperature of about 40°C;

30 (viii) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 50 weight percent 1,1,1,3,3-pentafluorobutane, from about 15 to about 45 weight percent trans-1,2-dichloroethylene and from about 1 to

about 6 weight percent ethanol, wherein said composition has a vapor pressure of from about 114.1 kPa to about 119.3 kPa at a temperature of about 40°C;

5 (ix) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 10 to about 50 weight percent 1,1,1,3,3-pentafluorobutane, from about 15 to about 45 weight percent trans-1,2-dichloroethylene and from about 1 to about 6 weight percent isopropanol, wherein said composition has a vapor pressure of from about 109.1 kPa to about 116.7 kPa at a temperature of about 40°C;

10 (x) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 30 to about 70 weight percent 1,1,1,3,3-pentafluorobutane and from about 10 to about 40 weight percent n-propyl bromide, wherein said composition has a vapor pressure of from about 91.1 kPa to about 106.3 kPa at a temperature of about 40°C;

15 (xi) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 12 to about 35 weight percent n-propyl bromide, and from about 1 to about 6 weight percent of methanol, wherein said composition has a vapor pressure of from about 98.8 kPa to about 110.8 kPa at a temperature of about 40°C;

20 (xii) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 12 to about 35 weight percent n-propyl bromide, and from about 1 to about 6 weight percent ethanol, wherein said composition has a vapor pressure of from about 93.8 kPa to about 103.3 kPa at a temperature of about 40°C;

25 (xiii) compositions consisting essentially of from about 10 to about 50 weight percent 1,1,1,2,3,4,4,5,5,5-decafluoropentane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 12 to about 35 weight percent n-propyl bromide, and from about 1 to about 6

weight percent isopropanol, wherein said composition has a vapor pressure of from about 89.6 kPa to about 99.1 kPa at a temperature of about 40°C;

(xiv) compositions consisting essentially of from about 20 to about 60 weight percent nonafluoromethoxybutane and from about 40 to about 80 weight percent 1,1,1,3,3-pentafluorobutane, wherein said composition has a vapor pressure of from about 82.7 kPa to about 96.9 kPa at a temperature of about 40°C;

(xv) compositions consisting essentially of from about 10 to about 40 weight percent nonafluoromethoxybutane, from about 50 to about 89 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10 weight percent of methanol, wherein said composition has a vapor pressure of from about 107.0 kPa to about 113.2 kPa at a temperature of about 40°C;

(xvi) compositions consisting essentially of from about 10 to about 40 weight percent nonafluoromethoxybutane, from about 48 to about 89 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 6 weight percent ethanol, wherein said composition has a vapor pressure of from about 92.0 kPa to about 102.2 kPa at a temperature of about 40°C;

(xvii) compositions consisting essentially of from about 10 to about 40 weight percent nonafluoromethoxybutane, from about 48 to about 89 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 6 weight percent isopropanol, wherein said composition has a vapor pressure of from about 90.7 kPa to about 100.5 kPa at a temperature of about 40°C;

(xviii) compositions consisting essentially of from about 10 to about 40 weight percent nonafluoromethoxybutane, from about 40 to about 80 weight percent 1,1,1,3,3-pentafluorobutane and from about 1 to about 10 weight percent acetone, wherein said composition has a vapor pressure of from about 88.0 kPa to about 96.3 kPa at a temperature of about 40°C;

(xix) compositions consisting essentially of from about 10 to about 50 weight percent nonafluoromethoxybutane, from about 30 to about 70 weight percent 1,1,1,3,3-pentafluorobutane and from about 10 to about 40 weight percent trans-1,2-dichloroethylene, wherein said composition has a



vapor pressure of from about 104.9 kPa to about 116.3 kPa at a temperature of about 40°C;

(xx) compositions consisting essentially of from about 10 to about 50 weight percent nonafluoromethoxybutane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 15 to about 45 weight percent trans-1,2-dichloroethylene and from about 1 to about 6 weight percent of methanol, wherein said composition has a vapor pressure of from about 121.1 kPa to about 127.8 kPa at a temperature of about 40°C;

(xxi) compositions consisting essentially of from about 10 to about 50 weight percent nonafluoromethoxybutane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 12 to about 45 weight percent trans-1,2-dichloroethylene and from about 1 to about 6 weight percent ethanol, wherein said composition has a vapor pressure of from about 104.9 kPa to about 114.8 kPa at a temperature of about 40°C;

(xxii) compositions consisting essentially of from about 10 to about 50 weight percent nonafluoromethoxybutane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 12 to about 45 weight percent trans-1,2-dichloroethylene and from about 1 to about 6 weight percent isopropanol, wherein said composition has a vapor pressure of from about 103.8 kPa to about 113.6 kPa at a temperature of about 40°C;

(xxiii) compositions consisting essentially of from about 10 to about 50 weight percent nonafluoromethoxybutane, from about 30 to about 70 weight percent 1,1,1,3,3-pentafluorobutane and from about 10 to about 40 weight percent n-propyl bromide, wherein said composition has a vapor pressure of from about 90.7 kPa to about 106.6 kPa at a temperature of about 40°C; and

(xxiv) compositions consisting essentially of from about 10 to about 50 weight percent nonafluoromethoxybutane, from about 20 to about 70 weight percent 1,1,1,3,3-pentafluorobutane, from about 12 to about 35 weight percent n-propyl bromide and from about 1 to about 6 weight percent of methanol, wherein said composition has a vapor pressure of

from about 101.8 kPa to about 113.2 kPa at a temperature of about 40°C,  
and  
wherein after 50 weight percent of said composition has evaporated, the vapor  
pressure of the remaining composition has changed by about 10 percent or less.

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3. A process for cleaning a surface comprising:

- a) contacting the surface with the composition of claims 1 or 2,  
and
- b) recovering the cleaned surface from the composition.

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4. A process for producing refrigeration, comprising condensing a  
composition of claims 1 or 2, and thereafter evaporating said composition in the  
vicinity of a body to be cooled.

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5. A process for producing heat, comprising condensing a composition of  
Claim 1 or 2 in the vicinity of a body to be heated, and thereafter evaporating said  
composition.